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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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08/26/2003

Patricia Beauregard Smith

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08/28/2008

TEXAS INSTRUMENTS INCORPORATED

P O BOX 655474, M/S 3999

DALLAS, TX 75265

EXAMINER

GOLIGHTLY, ERIC WAYNE

ART UNIT

PAPER NUMBER

1792

NOTIFICATION DATE

DELIVERY MODE

08/28/2008

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com

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Office Action Summary	Application No. 10/647,985	Applicant(s) SMITH ET AL.	
	Examiner Eric Golightly	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6,8-15,17,18 and 20-23 is/are pending in the application.
- 4a) Of the above claim(s) 20-23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6,8-15,17 and 18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-6,8-15,17,18 and 20-23 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. In view of the Appeal Brief filed on 6/16/2008, PROSECUTION IS HEREBY REOPENED. The rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

/Michael Barr/

Supervisory Patent Examiner, Art Unit 1792.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-6, 8-15, 17 and 18, drawn to a method for cleaning a wafer, classified in class 134, subclass 21.

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- II. Claim 20, drawn to a method for removing volatile cleanser compounds from a post-etch substrate, classified in class 134, subclass 1.1.
- III. Claims 21-23, drawn to a method used during fabrication of a semiconductor device, classified in class 134, subclass 17.

The inventions are distinct, each from the other because of the following reasons:

3. Inventions I and II, I and III, and II and III are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct if they do not overlap in scope and are not obvious variants, and if it is shown that at least one subcombination is separately usable. In the instant case, the subcombination of Invention I does not require the plasma strip as per Invention II or the use of OSG as per Invention III, and has separate utility such as cleaning a wafer; the subcombination of Invention II does not require the patterning a via or trench as per Inventions I and III, and has separate utility such as removing volatile cleanser compounds from a post-etch substrate; and the subcombination of Invention III does not require the low pressure as per Invention I or the plasma strip of Invention II, and has separate utility such as fabrication of a semiconductor device. See MPEP § 806.05(d).

The examiner has required restriction between subcombinations usable together. Where applicants elect a subcombination and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR

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1.104. See MPEP § 821.04(a). Applicants are advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

4. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

- (a) the inventions have acquired a separate status in the art in view of their different classification;
- (b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;
- (c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);
- (d) the prior art applicable to one invention would not likely be applicable to another invention;
- (e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

5. **Applicants are advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined** even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention.**

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicants must indicate which of these claims are readable on the elected invention.

If claims are added after the election, applicants must indicate which of these claims are readable upon the elected invention.

Should applicants traverse on the ground that the inventions are not patentably distinct, applicants should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

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6. During a telephone conversation with Timothy Hsieh on 8/22/2008 a provisional election was made without traverse to prosecute Invention I, claims 1-6, 8-15, 17 and 18. Affirmation of this election must be made by applicants in replying to this Office action. Claims 20-23 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention. Claims are previously 7, 16 and 19 are previously cancelled.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicants are advised of the

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obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 1, 8-15 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,643,407 to Chang (hereinafter "Chang").

Re. claims 1 and 8 Chang discloses a method of forming the intermetal dielectric layer of an integrated circuit. The reference teaches the patterning step (col. 2, line 45-col. 3, line 17), the wet cleaning step and the annealing step (col. 3, lines 18-37). Re. claims 9, 11, and 12, see col. 3, lines 44-47; and claim 1, 5. Re. claim 15, it is inherent in the Chang process. Re. claim 18, see col. 2, lines 55-57.

Chang discloses the claimed invention except for the anneal duration as claimed. However, Chang discloses using hydroxylamine as a wet clean solvent (col. 3, lines 19-21) and then skipping a O₂ plasma ashing (col. 3, lines 26-30) and before performing the annealing step (col. 3, lines 31-37). Since there is no O₂ plasma ashing, there is no O₂ plasma ashing decomposition of the alkyl in the organic spin-on-glass material to generate moisture (col. 3, lines 23-26) and, hence, such moisture is not a factor in the annealing duration. Rather, the hydroxylamine solvent is removed. It would have been obvious to one of ordinary skill in the art at the time of the invention to remove the hydroxylamine solvent in the Chan method in order to prepare the wafer for further processing, and to perform the anneal at a higher temperature than the boiling

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temperature of the component. Further, the annealing duration is a result-effective variable in that it is correlated with the removal of the solvent. The skilled artisan would have found it obvious to optimize the annealing duration of the Chang method to obtain optimal results through routine experimentation. See MPEP 2144.05(II). Regarding claims 13 and 14, it is noted that the boiling point of hydroxylamine is about 110 °C, so its annealing time would be less than the annealing time for dimethyl acetamide (DMAC) as taught in the present application, which has a boiling point of about 165 °C.

11. Claims 2, 5, 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang (US 5,643,407) in view of US 6,554,912 to Sahbari (hereinafter "Sahbari").

Regarding claim 2, Chang does not explicitly teach the claimed dielectric layers. Sahbari teaches a method of removing polymeric material from a substrate (abstract) and discloses using a silicon dioxide dielectrics layer (col. 7, lines 46-51), which is disclosed as advantageously having a low dielectric constant (id.). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a silicon-dioxide dielectric layer as per the Sahbari teaching in the method as per the Chang teaching due to the advantageously low dielectric constant of silicon-dioxide.

Regarding claim 5, Chang discloses an O₂ plasma ashing (col. 3, lines 20-22), or dry clean, but does not explicitly teach performing the dry clean before cleaning the polymer residue with the solvent. Sahbari discloses a dry clean prior to cleaning the residue (col. 8, lines 58-62), and further discloses that a wet clean, followed by a dry clean and a subsequent wet clean, which reads on a dry clean prior to cleaning the

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residue, enhances the cleaning (col. 1, lines 63-65). It would have been obvious to one of ordinary skill in the art at the time of the invention perform a dry clean prior to cleaning the residue as per the Sahbari teaching in the method as per the Chang teaching in order to enhance cleaning.

Regarding claim 6, Chang and Sahbari disclose using a plasma including oxygen (Sahbari at col. 12, line 67).

Regarding claim 17, Chang does not explicitly teach copper deposition. Sahbari discloses copper deposition (col. 8, lines 48-52). It would have been obvious to one of ordinary skill in the art at the time of the invention to perform copper deposition as per the Sahbari teaching in the metal deposition of the method as per the Chang teaching due to the advantageous conductivity of copper. Further, the skilled artisan would have found it obvious to perform copper deposition following the anneal in order to further process the wafer.

12. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang (US 5,643,407) in view of US 6,417,108 to Akino et al. (hereinafter "Akino").

Chang does not explicitly teach using a wet clean solvent comprising an acid. Akino teaches a method of manufacturing a semiconductor substrate (abstract) and discloses using a wet clean solvent comprising hydrofluoric acid (col. 6, lines 30 and 31). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a wet clean solvent comprising an acid as per the Akino teaching in the

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method as per the Chang teaching because hydrofluoric acid is known in the art and can remove silicon dioxide without removing silicon.

13. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang (US 5,643,407) in view of Akino (US 6,417,108) and in further view of Sahbari (US 6,554,912).

Chang and Akino do not explicitly teach using a solvent that comprises dimethyl acetamide ("DMAC"). Sahbari discloses using a solvent that comprises DMAC (col. 6, lines 33 and 34), which has an advantageous water miscibility (col. 6, lines 25 and 26). It would have been obvious to one of ordinary skill in the art at the time of the invention to use DMAC as per the Sahbari teaching in the method as per the Chang and Akino teachings due to its miscibility.

Response to Arguments

14. Applicants' arguments with respect to claims 1-6, 8-15, 17 and 18 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric Golightly whose telephone number is (571) 270-3715. The examiner can normally be reached on Monday to Thursday, 7:30 AM to 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on (571) 272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael Barr/
Supervisory Patent Examiner, Art
Unit 1792

EWG